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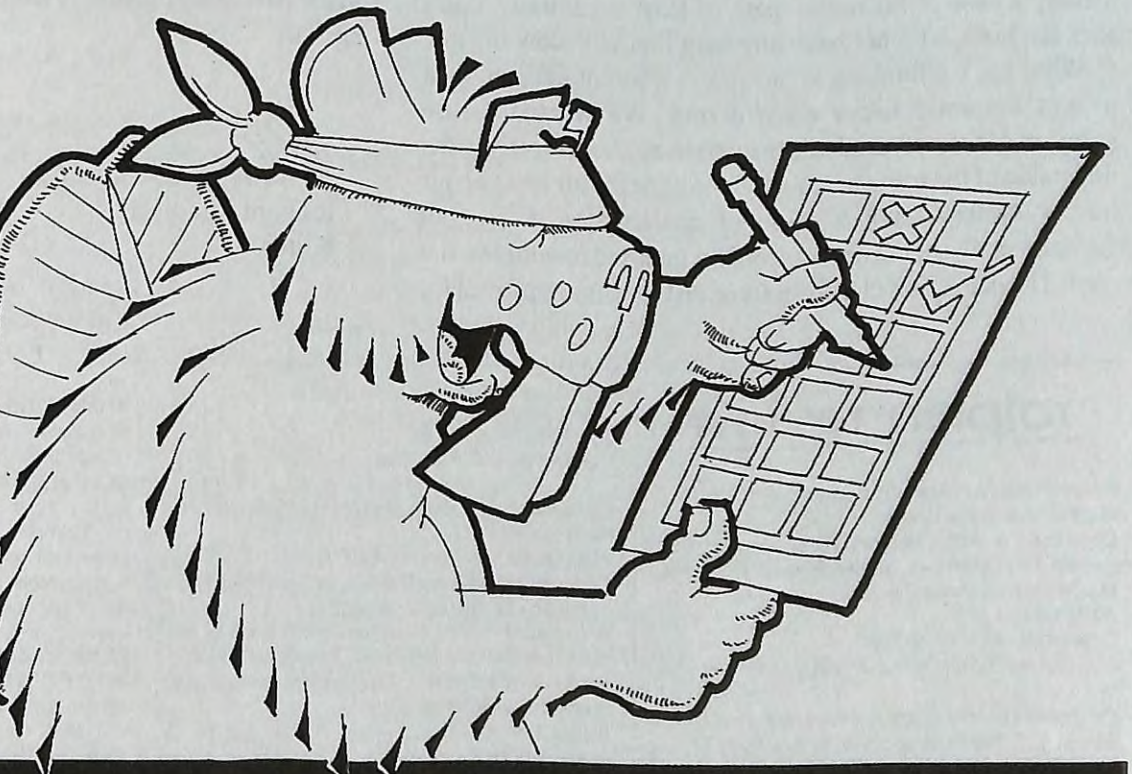

From the Editor . . .

Regular readers know that I am not at all fearful of regulations. Regrettably, minimum standards have to be set and enforced, or else appropriate minimums will not be followed as there are always those who will cut corners.

The dilemma is what happens when the standards are not clear enough, too rigid, or if new technology is introduced, who interprets what is an acceptable alternative? The building code is quite specific on most construction topics. However, there is a provision for interpretations and to prove an equivalency - but it can be time consuming, especially if some of the players are not comfortable with the process.

In a perfect world, builders, designers and inspectors would all be well-educated professionals open to discussion and evaluation of any deviation from the norm. As we all know, the world is not perfect. Far too many players are under educated, so when confronted with anything different, they head for the hills, to avoid making any decision. For municipal building inspectors, it's often a case of not making a decision that might mean deviating from the norm. In fact, many inspectors see their job as protecting their employer (not the public) from exposure to legal actions, so they are very conservative in their interpretations. For a builder, it is usually a case of taking the path of least resistance - don't rock the boat, let's not have anything that will slow the job.

What got me thinking about this is a recent incident on a project currently under construction. We wanted to use spray-in-place polyurethane insulation applied directly to the underside of the roof sheathing, to provide the air and vapour barrier system - not a standard construction detail, but fundamentally not different from an inverted membrane flat roof. The detail was clearly marked on the plans approved for construction, but the street savvy builder insisted we make sure the building inspector saw and approved the detail before roof framing was started.

I discussed the detail with the inspector and supplied additional documentation (the same documentation I prepared for use in another municipality and accepted by other jurisdictions). The inspector had never seen this detail before, and it quickly became clear that he did not understand fundamental building science. He would accept an inverted membrane roof (i.e., put the insulation on top of the roof deck) but not under the deck as proposed, because, he insisted, how would the moisture get out? He was not able to explain where the moisture was going to come from. The code calls for vented roofs, period. For most (but not all) roof structures that may be appropriate. Waiting for two months to get a ruling on an equivalency was not appropriate in this situation, so the detail had to be changed in the interests of expediency.

The building code is being rewritten toward an objective-based document. This should make it easier to deal with innovations, as the code will only state the intent of a requirement rather than saying how you have to meet it.

However, it still requires a certain degree of competence on the part of all players. That, unfortunately is difficult to legislate.

Richard Kadulski,
Editor

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Selecting a Heating System

by Baron Fowler

The heating system is an important element in any building and each has its own advantages and disadvantages. This assessment tool will provide you a way to determine which system is "the best" for your particular circumstances, location and biases.

It recognizes that no system is perfect. However, we can go a long way to reduce the disadvantages by using some knowledge before we get started. The simplest and cheapest method to reduce the need for heating is to improve the energy conservation features of your house, such as improving insulation, air sealing the house, reducing north windows and increasing south window areas (within reason) to take advantage of solar gains. Reducing heat losses by energy conservation is very cost effective and must be undertaken before looking at what heating system to use. Our ultimate goal should be to eliminate the heating system altogether!

Common heating system types

1. Forced Warm Air Furnace:

The most commonly used central heating system uses ducts to distribute heated air. Many fuel sources are possible. Some hydronic systems use hot water as the heat source for a fan coil for warm air distribution.

Advantages: moderate cost, warm external surfaces, easy to control, low internal pollution, clean, allows for effective whole house air filtration, and humidity control can be added if needed. Solar heat can be distributed by using the air circulation system, especially if the return air is placed high up, to draw hot air from the ceiling zone and circulate it through the house or under floor for storage.

Disadvantages: no radiant heat component, potential for high temperature gradient, high air circulation, thermal monotony, noise, odours, warm ceiling/cool feet, fails in power outage (needs power for fan), more costly than baseboards, requires periodic maintenance, large volumes of space required to accommodate air ducts. A poorly installed system can be a source of irritation, drafts and noise.

2. Electric Baseboards:

Often used as an automatic back-up system for other types of systems, electric baseboards are low cost to install, but expensive to operate.

Advantages: temperature control in each room, low air circulation, low noise, warms and dries exterior walls, low internal pollution, easy maintenance, 100% efficient on site. If the source of electricity is hydro based, then it is low polluting.

Disadvantages: high surface temperature of heating elements, high temperature gradient, registers can interfere with furniture placement, potentially high electromagnetic fields, odours from scorched dust, visually unpleasant, no humidity control, high energy costs.

3. Hydronic systems:

A central water heater uses hot water to distribute heat, typically through baseboards. (Floor radiant is described separately).

Advantages: compact distribution piping, thermal mass in the system tends to provide a more even distribution of heat, easier to zone, and low air circulation.

Disadvantages: can involve higher capital cost, higher surface temperature of baseboards, no humidity control, does not lend itself to air filtration.

4. Wood Stove:

High efficiency wood stoves (meeting EPA emission standards) reduce air pollution and wood consumption.

Advantages: provides some radiant heat depending on the stove design and location, low air circulation, no thermal monotony, some warming of external walls, no static charges, quiet except if there is a fan, some humidity control (drying wood adds moisture), visually appealing, secure in case of power outage. Fire is emotionally appealing and wood is a renewable fuel, moderate installation cost, low/moderate fuel cost, gives homeowner lots of exercise.

Disadvantages: high maintenance (cleaning, chimney sweeping), high surface temperature depending on material and design, high temperature gradient, heat distribution through the house can be problematic. Temperature control is simple, stove needs an automatic back-up system, generates odours/smoke, high interior pollution/mess/

dust/bugs, can be a fire hazard, may increase home insurance costs, requires wood shed, tools, etc., time consuming for homeowner.

Wood burning efficiency depends on the moisture content of the wood. Wood dries under cover at the rate of one inch per year. A six inch diameter log takes three years to dry completely. A solar wood drying shed can easily be constructed by enclosing a traditional wood shed in recycled glass or plastic and allowing good air flows. Higher temperatures will dry wood about 50% faster.

5. Heat Pump:

A heat pump essentially is the same as a refrigerator; it extracts heat from one area and places it in another. Most are reversible in summer to provide cooling. Typically the heat source is air, but it can also be a ground or water source. Air systems use electricity as back-up when the air temperature falls below freezing. Heat is usually distributed as in a forced warm air system, but radiant floor hydronic systems can also be used.

Advantages Easy to control, easy cleaning, low odour, invisible inside but air units visible outside, humidity can be controlled, energy source is solar/earth heat, low external pollution, very efficient when compared to electric furnace.

Disadvantages: Similar to forced warm air heating, potential electromagnetic fields around the units, units can be very noisy, circulates dust, high installation cost, usually not cost effective for small energy efficient houses.

Requires competent system design and proper installation. System has to be designed to accommodate lower air temperatures (fuel fired furnaces typically heat the air at the furnace to a higher temperature) or there may be uncomfortable drafts. Regular ongoing maintenance is required. Most units use HCFC's.

6. Radiant Ceiling:

A system that uses electric panels installed in the ceiling. The heat radiates down from above.

Advantages: 100% radiant heat, low surface temperatures, objects (not air) are heated, moderate temperature gradient, low air circulation, warms external surfaces, low static charges, easy to control, silent, no odours, invisible, very clean. Low pollution if hydro based power, more efficient than baseboards or furnace, well suited to bathrooms or special use areas.

Disadvantages: potentially high electromagnetic fields at ceiling level, no humidity control, warm head/cool feet, no solar integration, higher installation cost, fails in power outage.

7. Radiant Floor:

Floor is usually heated with hot water pipes, but electrical cables are sometimes used.

Advantages: large radiant surface, low surface temperature, objects (not air) are heated, low air movement, low thermal monotony if rooms are on separate zones, warms external walls in straight line, no static, system easy to control, easy cleaning, usually low/no noise, invisible system, warm feet/cool head, floor thermal mass can absorb solar heat, no internal pollution if heater is located outside the house, fuel efficient due to lower air temperature, lower operating costs than other systems, can be installed under wood or concrete floors.

Disadvantages: Expensive to install, for optimum performance requires thermal mass be sized carefully as high floor temperatures are not healthy for legs, pumps and pipes may create noise, leaks are difficult to fix in concrete, system may freeze up if power fails during a cold spell in a poorly insulated building. Rugs will lower heat flow into room unless system is designed for carpet floors.

8. High-Mass Fireplace:

These are also known as masonry, Russian, Finnish, Kachelofen or European tile stoves. All are similar and burn the fuel very fast at high temperatures for maximum combustion efficiency in a high thermal mass structure, and then store the heat in the mass of the heater and chimney. These units can achieve efficiencies of up to 80-90%.

Advantages: Primarily radiant heat, low surface temperature, low temperature gradient in room, low air circulation, no thermal monotony, warms external walls in straight line from heater, no static charges, no noise, can be very aesthetically appealing, can warm floor in straight line from heater, some air exchange, not reliant on electric power, emotionally appealing and cosy, stores solar heat, low external pollution, low wood consumption in comparison to all other wood heaters, low fire hazard.

Disadvantages: only surfaces in a straight line will be heated by radiant heat, heat distribution to other rooms/areas may be difficult unless designed to do so, very heavy (needs massive foundation), heat regulation is tricky, wood creates dirt/dust/bugs, possibly smoke, high installation cost, higher fire insurance, higher maintenance.

9. Solarium/Greenhouse:

A south facing greenhouse or solarium can provide a significant amount of heat especially if the temperature is allowed to cycle. It may require additional heat if minimum temperatures are to be maintained.

Advantages: some radiant heat, low surface temperatures, no thermal monotony, no noise, pleasant odours from flowers, humidity supplied from plants, natural air circulation and air purification by plants, very pleasant emotional feeling, no external pollution, adds area to house, can produce food, flowers, enjoyment.

Disadvantages: does not produce all the heat required, negative effects of the back-up system, difficult to regulate heat distribution, dust/dirt/bugs, may create excess humidity, may be expensive to install depending on size/style. Will overheat during the summer unless proper controls are designed. Will be a net energy loss if homeowner uses space year round as fully conditioned living space.

10. Passive Solar :

A passive solar house is specifically designed to be solar heated and highly energy efficient with some heat storage mass and possibly air circulation to distribute the heat. Back-up heat assumed to be electrical due to low cost of installation and need for automatic system.

Advantages: moderate radiant heat, low surface temperatures, low air circulation, low thermal monotony, warms external walls, no static charges, no electromagnetic fields, easy cleaning, no noise, no odours, usually invisible, some humidity control, high aesthetic value, pleasant, no pollution, infinite fuel, low annual cost, water preheating possible.

Disadvantages: high temperature gradients, difficult to regulate, cool floor depending on heat distribution and storage, moderate installation cost depending on design and additional energy efficiency above building code minimums. High temperature swings are possible, so there may be overheating in spring and fall due to low sun angle. Fabrics may fade faster due to excessive sun.

Criteria for Heating System Evaluation

Use the Heating System Evaluation Form (page 7) to rate each criteria from 1 to 9 in terms of importance to you. The lower the number the worse or less important it is; the higher the number the better the system is for that criteria. You will find it may not be easy to determine which system is better or worse than another system. Try to be as consistent as you can based on your own or your client's biases.

Radiant Heat

Radiant heat is a comfortable type of heating. Air temperatures can be kept much lower (for equivalent comfort) than other systems. This can reduce heating cost substantially. Radiant heat will heat any surface or object in a straight line from the heat source. External walls and other objects are thus heated, reducing heat loss from the body, storing heat and re-radiating this heat as the room cools.

Surface Temperature of Heater

Hot surfaces are dangerous to touch, and cause dust scorching and odours. Metal surfaces should not exceed 70° C (158° F) especially when they are exposed and easily accessible. Floor surface temperatures should not exceed 25.5° C (78° F)

Surface Temperatures of Objects

Higher surface temperatures are more comfortable. All construction materials and furniture store heat and re-radiate it as the room cools. Obviously, some materials have a higher thermal storage capacity than others.

Temperature Gradients

For maximum comfort the temperature difference from floor to ceiling and from internal to external surfaces should be as low as possible; ideally, not more than 2° C (3-4° F).

Air Circulation

Low air circulation is desirable to reduce drafts and dust circulation. Air contains dust particles, viruses, bacteria, dust mites, vapours and odours. However, slow air circulation is useful to distribute heat to other parts of the building.

Air Filtration

The ability to clean the air in a building is important. Medium efficient pleated filters provide reasonable control of particulates if they can be installed.

Thermal Monotony

Absolutely uniform temperatures from room to room can be unhealthy. It is preferable to have

some temperature variation in different areas and over the day. Temperature control in each area is desirable.

External Surface Temperatures

Cold external walls/windows create uncomfortable drafts. Heat is radiated from a warm body to a cool one. This causes discomfort and makes us add heat to the room. Surface temperatures of exterior walls and ceilings depend largely on wall/window insulation values which should be high.

Static Charges

Static charges cause unpleasant sparking and charge surfaces electrically. Low humidity levels are the main cause.

Electromagnetic Fields

These invisible fields surround any electric element: heater, in-floor wiring or ceiling panel, motor, fan, pump, or other electric wiring that is not shielded or grounded properly. Keeping these at a minimum is desirable.

System Regulation/Heat Distribution

Is operation and control simple? Can the temperature of each room be adjusted? Is a back-up system required? How fast can the house be warmed after cooling? Is heat distributed to all rooms? How much work is involved?

System Cleaning

How much maintenance is required? Can the system be easily cleaned? Does the system create or spread dust, dirt, smoke, odours, chips, bugs, oil, etc.?

Noise

Is there much noise produced by fans, pumps, expansion/contraction of elements, switching on/off, vibrations, flowing water?

Odour Creation

Rate the production of smoke, dust scorching and vapours.

Aesthetics

Is the system or its visible fittings decorative, colourful, attractive?

Humidity Control

Ideal humidity is between 40-60% relative humidity (30% minimum in winter). Can the system regulate humidity levels?

Ventilation Integration

Air exchange is critical to health. Does the system allow slow, natural air exchange; but prevent drafts? Does it allow integration with the ventilation system?

System Security

How well can the system withstand extreme impacts such as power outages, fire, wind, earthquake, extreme cold disruption in fuel supplies?

Emotional Factors

How does the system rank in terms of nostalgia, cosiness, social focus, entertainment, aesthetics, plants and flowers, enjoyment, exercise?

Solar & Natural Lighting

Rate for: free solar heat contribution, heat storage and distribution, and amount of natural light admitted.

Internal Pollution Generation

How much pollution in the form of smoke, dust vapours, scorched dust, wood chips, gas/oil leaks, bugs, etc. is generated inside?

External Pollution Generation

Rate the production of smoke, toxic gases, carbon dioxide and other particulates, during the manufacture, transport, installation and operation of the system.

Fuel Sustainability

How long will the fuel supply last? Consider future pollution reduction legislation that may affect the fuel source.

Installation Costs

What is the total system installation cost? Include the cost of floor space that is used by the system and is unusable for other purposes. Don't forget to include other necessary items such as: wood shed, oil tank and hook-up fees to the gas or hydro system. Is an automatic back-up system required by the building code or the bank?

Annual Operating Costs

What is the total annual operating cost, including chimney cleaning, maintenance and additional insurance (if applicable)? Some systems (e.g. wood or pellet burning systems) have other costs that may include: possible water/burn damage to furnishings & carpets, wood cutting/hauling cost, chain saw, truck, up keep, etc. How much time is involved to run the system and how much is the time worth?

System totals

Add up all figures for each system.

Hybrid Systems

Some systems may be a hybrid of two or more separate systems. Evaluate each separately, and average the system totals together depending on the percent of their contribution to total heating. For example: if the forced warm air system contribution is 50%, a woodstove contributes 45% and baseboard electric contributes 5%. Add together: 50% of the forced warm system total, plus 45% of the woodstove, plus 5% of the baseboard electric totals. This will give you an overall figure for the total combination systems.

System Rating

The highest total is the best system and gets ranked number one. Rate each system in descending order. You may be surprised!

Rationalization

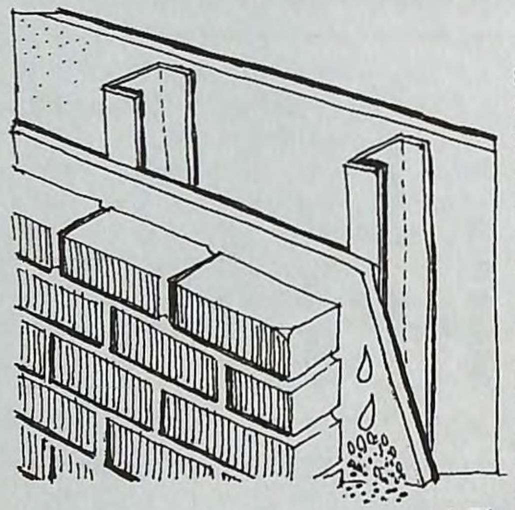
This is the hardest part! Now that you have calculated the mathematical "best" system for your particular situation, you must decide if it is the system you really want. It's worth taking the time at this point to look at the "big picture" - you (or the next homeowner) will be living with your decision for the life of the house, so remember to review the accumulated cost. It may be better in the long run to choose a slightly-more-expensive energy-efficient system, which will ultimately pay for itself many times over.

Baron Fowler is a designer and builder living on Saltspring Island, B.C.

Heating System Evaluation Form

Criteria:	Forced Warm Air Furnace	Electric Baseboard	Hydronic Systems	Wood Stove	Heat Pump	Radiant Ceiling	Radiant Floor	High Mass Fireplace	Solarium	Passive Solar	
Radiant Heat											
Surface Temperature of Heater											
Surface Temperatures of Objects											
Temperature Gradients											
Air Circulation											
Air Filtration											
Thermal Monotony											
External Surface Temperatures											
Static Charges											
Electromagnetic Fields											
System Controls											
System Cleaning											
Noise											
Odours											
Aesthetics											
Humidity Control											
Ventilation Integration											
System Security											
Emotional Factors											
Solar Energy and Natural Lighting											
Internal Pollution Generation											
External Pollution Generation											
Fuel Sustainability											
Installation Costs											
Annual Operating Costs											
System Totals											

Brick Veneer Steel Stud Wall Performance



The brick veneer/steel stud wall system has become very popular in recent years, especially in multi family and commercial projects. However, adequate design and construction standards have not been developed, as has been identified in a recent study for CMHC.

A test wall in a seven-storey Ottawa residential building was monitored. It represents an average condition typical of current practices. To look at the worst conditions, a wall section on the east side of the top floor of the building was tested. The wall location was selected to avoid the effects of any penetrations such as telephone and cablevison outlets and to ensure that the test location was not immediately next to columns or corners.

Temperatures, moisture and air pressure were measured over a year, and then opened after the monitoring was done to verify the results of the data analysis. The results show that good thermal performance can generally be expected from brick veneer/steel stud walls. As expected, significant thermal bridging was measured at the steel studs due to a lack of exterior insulation. This thermal bridging is typical of any steel stud wall without exterior insulation.

Severe dust marks were observed on the interior surface of the drywall at the studs, a result of thermal bridging through the studs. Dusting was so bad that even the locations of the dry wall screws were evident.

The performance problems identified in this study are mainly due to an ineffective air/vapour barrier system, inadequate cavity venting and a lack of exterior insulation. Design shortcomings are causing the performance problems, although the wall design is of typical construction.

As a rain screen, the wall system generally performs in a satisfactory manner. However, it did not perform as well as needed as pressure equalization is not fully effective. The cavity couldn't dry out because more condensation was happening (due to a faulty air barrier) than could be removed by natural convection movement of air through the weep holes. In addition, the back face of the brick veneer stays wet throughout the winter when many freeze/thaw cycles occur. Experience has shown that condensation on the back face of the brick veneer may lead to back spalling on the bricks due to freeze/thaw action. Minor condensation also regularly occurs on the interior surface of the exterior sheathing.

Air leakage was also noted through the air/vapour barrier system although the workmanship appeared satisfactory. While air leakage seems relatively minor, there was enough to allow a significant amount of moist interior air to penetrate into the backup wall. It also can cause a reduction in the thermal efficiency of the wall system under wind conditions.

Condensation also happened on the brick ties and the exterior surface on the exterior gypsum board sheathing. Condensation within the cavity can lead to corrosion and eventual failure of the brick ties. Air leakage and the lack of adequate cavity venting at the test building will likely result in a reduced service life.

Two inspection holes were made in the wall: one four feet from the floor, and one at the floor level. It was noted that the building paper and exterior gypsum board were very wet and mildew covered much of the interior surface of the exterior gypsum sheathing. The exterior surface of the glass fibre insulation was also damp, with some insulation at the bottom of the wall being very wet. The insulation was stuck to the exterior gypsum board at both openings.

A cut in the polyethylene vapour barrier was observed at the lower opening. An attempt had been made during construction to repair the vapour barrier with another small piece of polyethylene crudely sealed around the cut using acoustical sealant. The repair was unsuccessful as significant dusting was observed on the insulation at the cut in the vapour barrier. So much moisture escaped that the copper element of the condensation sensor had oxidized, making the sensor useless.

A gasket had been used on the electrical outlet beside the lower opening but leakage through the outlet was still observed on the cover plate.

The steel studs, lateral bracing and bottom track were in good condition but the bottom track had some minor oxidation.

Performance Monitoring of a Brick Veneer/ Steel Stud Wall System *for Canada Mortgage and Housing Corporation By Keller Engineering Associates Inc.*

Concrete Reinforcement

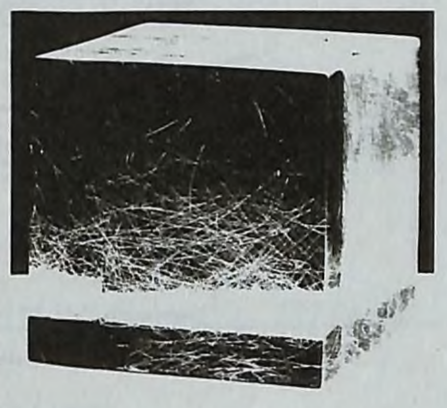
Non-Structural Cracks in Concrete Slabs

Concrete is strong in compression, weak in tension. This means it has a tendency to crack, which has been accepted as natural to its use.

Cracks occur in concrete because stresses exceed the strength of the concrete at the time. Stresses from external forces can be offset by providing higher structural strength and reinforcing to concrete structures, pavements and slabs. Another source for concrete cracks is drying shrinkage. These cracks form within the first 24 hours after concrete has been placed.

Shrinkage cracks generally pass through the entire slab and form planes of weakness, permanently lowering the integrity of the structure before the concrete has had the opportunity to gain its design strength. Settlement and shrinkage cracks may not be observed until some later date. They are often surface sealed by the finishing operation or are simply not wide enough to be seen until the concrete shrinks further or a load causes the weak planes to grow into visible cracks. The traditional approach for dealing with this weakness is to use welded wire mesh in floor slabs.

However, for the mesh to be effective it has to be placed correctly near the mid point of the slab. This means the mesh has to be carefully lifted during the pour. This rarely happens properly, given that the cement finisher has to stand on the mesh as he's lifting it. The reality is, mesh location is often a hit and miss effort in less than the optimum locations.



There is an alternative: fiber reinforcing, (polypropylene fibers ¾" long) mixed throughout the concrete. These fibers are mixed uniformly throughout the concrete to provide secondary reinforcement for shrinkage crack control. As the concrete hardens and shrinks, the stresses are taken up by the fibers. Being totally inert, the fibers don't affect the finishing characteristics of concrete. Fiber reinforcing replaces welded wire fabric when used for secondary (crack control) reinforcing in concrete.

Fiber reinforcing is nonmagnetic, rustproof, alkali resistant, and requires no minimum concrete cover - it is always positioned in compliance with codes. A safe, easy-to-use product, it reduces construction time and eliminates the hassle of welded wire mesh on the jobsite.

There are several manufacturers of these products. Some products have stiffer fibers than others; stiff fibers can be a problem to finish sometimes, leading to a hairy slab.

EcoDesign Launches World Wide Web Site

The focus of the new EcoDesign site is on the impact the built environment has on the globe from a regional perspective. The EcoDesign site offers access to searchable catalogues on:

- the EcoDesign Resource Centre's extensive environmental design and construction library
- building products that demonstrate health and environmental innovations
- generic environmental product information and design guidelines
- architects, designers, related consultants, and builders actively incorporating principles of ecology into their practices *(you can see a photo of the Great Canadian Reno-Demo on the site, under Richard Kadulski Architect).*
- organizations active in the field of ecological design and building

What does EcoDesign mean by eco- ?

It means practitioners and organizations, projects and building products that are exemplary in demonstrating principles of ecology with consideration of air and water quality, conservation and efficient use of resources, waste reduction and recovery systems, hazardous materials remediation, and or sustainable development patterns.

The EcoDesign database is open to eco-practitioners and organizations, projects and building products from British Columbia and other parts of Canada.

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Book Review

A Guide to Energy Efficient Ventilation

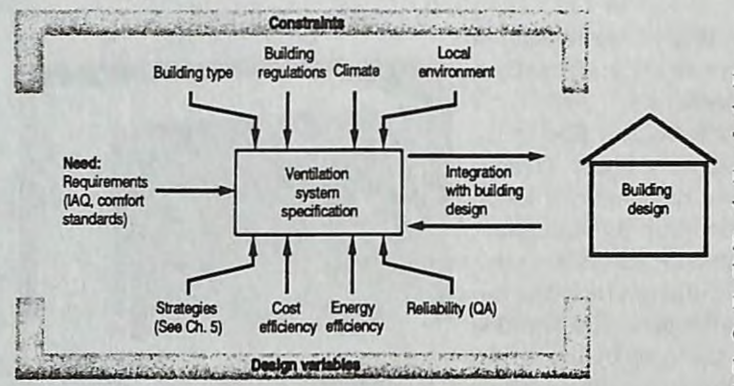


Figure 4.1 Essential Design Parameters

Still confused about ventilation? This welcome new book provides the background of ventilation - a technology in its own right. Author Martin Liddament correctly says that ventilation system design today is based on existing hardware rather than on real needs; perhaps he's saying this because ventilation is sometimes considered as a tag-along to heating and cooling systems and as a result has often been compromised. He cuts through this ignorance, returns us to basics and states clearly that humans need fresh air (whether for houses or offices). He says that this need should drive all good system and equipment design.

Book review by David Hill, president of Eneready Products Ltd., a Vancouver based distributor of ventilation equipment

One strength of this 254-page paperback book is Liddament's in-depth review of ventilation concepts. Of the 12 chapters in this book, 10 accomplished this introduction of concepts for me. The following statements were a delight to this reviewer's eyes; the ideas seem so obvious and basic, yet are confused by so many supposed 'experts' today:

A) The prime role of ventilation is to dilute and remove pollutants from unavoidable sources. In essence these are the ones generated by the occupants and their essential activities. Moisture is the prime one. Too often it falls upon ventilation to accomplish tasks for which it is inappropriate. Using ventilation to dilute the avoidable interior pollutants is not the most effective means and a cause of continuous energy waste in the process.

B) Once you have ventilated at 20 cfm/person, indoor air quality is almost always affected by pollutants in the space rather than the inadequacy of ventilation.

C) In order of importance, the amount of energy consumed by ventilation is affected by:

1 - reducing the need for ventilation
2 - avoiding uncontrolled air loss through the building envelope ("Build tight - Ventilate right")
3 - controlling ventilation by demand
4 - using heat recovery

D) Air leakage from seams and joints in ventilation heating and air-conditioning ducts can be substantial.

E) Slight 'under pressure' is desirable for building wall and ceiling moisture protection.

F) Summer ventilation is different from winter or 'metabolic ventilation,' which is installed and sized for human health when the building is closed. Summer ventilation is primarily installed to meet thermal comfort.

Despite the excellent points of this book, I can't resist commenting on the following areas.

One of the key ventilation appraisal tools that Liddament has overlooked is the well-trained nose. Perhaps the goal of good ventilation would become more achievable if we rated success in terms of satisfying this instrument in addition to the electronic ones. Except for a brief mention of Dr. Ole Fanger and his 'olf', this sensitive human instrument was not mentioned. In this reviewer's experience, the ventilation practitioners who achieve the best results are those who have developed a good nose to complement their use of airflow measurement and other standard tools.

Liddament uses the terms "natural" and "passive" interchangeably. Natural implies wholesome and good yet, as an energy expert, Liddament correctly points out that air leakage creates major heat loss during the heating season. Perhaps more important to the consumer is the discomfort that this uncontrolled raw leakage creates. Also, while leakage does contribute toward providing freshness to a building, it contributes far less to the 'breathing zone' than the cfm numbers alone (and the resulting heat loss) would suggest. Passive ventilation is different. When we understand subtle natural forces and apply them correctly toward this goal, we provide effective ventilation. This certainly doesn't happen automatically when we compromise on construction quality and build leaky buildings.

Further, air changes per hour may be a good way of assessing building heat loss but it is an inappropriate way to determine the contribution which leakage makes toward providing indoor air quality. Perhaps Liddament's duty (serving the International Energy Agency) has lured him to clouding the difference.

The last two chapters of this book cover tracer gas techniques and mathematical modelling. While this maybe used by some segments of the ventilation industry, it seemed a little odd to have these included within this mostly practical book. The last two chapters are seemingly dedicated to those in research level work.

With today's renewed concern about space heating energy, it is refreshing to see this interest on the health front. Our quality of life does depend on the air we breathe. If we are not healthy how can we enjoy the thermal comfort we now are able to put into buildings today? To achieve affective ventilation without the 'sour notes' (of thermal discomfort, noise and excessive utility bills) require that we apply a heavy dose of common sense, return to basics and raise the installation quality of building mechanical systems, which are disasters in small buildings today. If you are a ventilation system designer who likes to solve problems rather than cure symptoms, you would do well to read the first ten chapters of this book before your next job. It is original and an eye-opener. This reviewer will add this book to his library.

If you work in housing this book is a natural lead-in to the following, which are housing specific.

Residential Ventilation: Achieving Indoor Air Quality by Richard Kadulski or ***Understanding Ventilation: How to design, select, and install residential ventilation systems*** by John Bower.

A Guide to Energy Efficient Ventilation by Martin Liddament (head of the Air Infiltration and Ventilation Centre in England) is available for £50.00 (pounds sterling) from:
Air Infiltration & Ventilation Centre, University of Warwick Science Park, Sovereign Court, Sir William Lyons Rd., Coventry, CV4 7EZ, Great Britain

Tel: 44 (0) 1203 692050
Fax 44 (0) 1203 416306
e-mail: airvent@aivc.org
Internet: http://www.demon.co.uk/aivc

Guidelines for Creating Healthier Homes

Houses contain many substances that can contribute to unhealthy conditions.

The **Guidelines for Creating Healthier Homes** is a new, pocket sized, condensed, self-help guide that synthesizes available data. The material is presented as a list of priorities, identifying problem substances, where they may be found, why they should be reduced or eliminated and a brief discussion of how to accomplish this.

Lyse Tremblay, the author, is a Montreal architect specializing in healthy buildings. She put together the guide because, in spite of the fact that much research has been done worldwide on the subject of indoor air pollution, many people are still unaware of the potentially harmful effects of common household products, materials and activities.

Her interest in the subject of healthy buildings is both personal and professional. Having developed asthma and multiple allergies, she became interested in the subject. Her personal experience has demonstrated that the detrimental effects of polluted buildings and, conversely, the healing effects of healthy buildings cannot be understated.

Guidelines for Creating Healthier Homes
$9.95 is available from
LMT Publications
1685 Adoncour
Longueuil, PQ, J4J 5L4.

Priorities for Healthier Homes

1. Cater to known allergies and sensitivities
(Eliminate the contributing source of the allergy or sensitivity if possible).
2. Reduce exposure to substances that are potentially lethal in the short term
(e.g.carbon monoxide)
3. Reduce the impact of outdoor pollution sources
4. Eliminate dangerous activities inside your home
(Lifestyle issues)
5. Reduce exposure to dangerous gases and substances causing serious long term exposure effects.
(radon, lead, asbestos, respirable particles)
6. Reduce exposure to contaminants that can spread throughout the house or cause sensitivities in previously non allergic people.
(eliminate sources for mold, mildew and bacteria, formaldehyde, Volatile Organic Compounds [VOCs], toxic metals)
7. Reduce exposure to other contaminants
(dust mites, animals, pollen, feathers and down, ozone, terpenes, electromagnetic fields [EMFs])
8. Ventilate to exhaust pollutants and bring in fresh air
The first line of action should always be to eliminate polluting substances. If they can't be removed easily, separate them from the living environment either by sealing or enclosing them so that the emissions are considerably decreased. Finally, ventilate to dilute the concentration of remaining pollutants and bring in fresh air. Do not, however, rely on ventilation alone to permanently solve an indoor air pollution problem.

Technical Research Committee News

Canadian Home Builders' Association

Housing Code

Changes are being made to the National Building Code, with a significant move toward an objective-based code. This will likely mean that Part Nine (which covers housing and small buildings), will disappear. As a result, a separate housing code is being considered, to cover single detached and semi-detached houses.

The Canadian Commission on Building and Fire Codes (CCBFC) is proceeding in this direction on the assumption that this will benefit the industry. However, it appears that there has never been any clear definition of what this means or what the implications of this process are. CHBA will be working to obtain a clear understanding from the CCBFC what this means and then will be going to its membership to develop a position regarding support for this change.

Envirohome

This program offers builders a marketing opportunity to promote the professionalism of the builder and his/her partners, and increase awareness of healthy, energy efficient, environmentally responsible housing. This is an excellent occasion to generate prequalified traffic to a project and generate valuable leads for future work.

The technical requirements for an Envirohome project are that it must be an R-2000 home, and meet or exceed all the environmental options listed in the R-2000 Technical Requirements.

Currently there are four Envirohomes underway or completed in 1996: Radiant Homes in Armdale, Nova Scotia opened its Envirohome in April, Lakewood Homes in St. Catherines, Ontario opened its in June. Two homes are under construction: Koehn Construction (with Richard Kadulski Architect) in White Rock, BC (scheduled to be open late September), and Gannet Homes in Edmonton later this summer.

Applications for the Envirohome are available from the CHBA National office.

The Technical Research Committee (TRC) is the industry's forum for the exchange of information on research and development in the housing sector.

Canadian Home Builders' Association,
Suite 200, 150 Laurier Ave. West, Ottawa, Ont.
K1P 5J4
Tel: (613) 230-3060
Fax: (613) 232-8214

Mechanical Ventilation Requirements

Still find the new proposed requirements confusing? CMHC will be issuing a document outlining the new Part Nine requirements by the end of July. Contact the Canadian Housing Information Center (613) 748-2000 for a copy.

Scientific Research and Development Tax Credits and Housing

Revenue Canada can understand that a manufacturer improving windows or other building materials is engaged in search and development (R&D), but it seems unwilling to accept that the same R&D parameters apply to the concept of "house as a system". Perhaps a problem is that a house has a residual value, while a product prototype does not. To fit Revenue Canada's rules, a prototype must be destroyed.

This issue has surfaced as applications by the Advanced House projects for the R&D tax credit have been rejected. After strictly following the guidelines set out by Revenue Canada, builders are discovering that the tax credits won't be issued.

In another instance, a builder applied under the same criteria as the Advanced Houses (following guidelines suggested by Revenue Canada) and was rejected, and was then subjected to a full company audit and was fined $50,000 for "gross negligence" under the Income Tax Act. An appeal is underway.

The moral of this story: beware of the R&D Tax Credit. Apply at your own risk. R&D credits do represent an easily accessible means of support for innovative product development. However, it does require a clear-cut understanding of the nature of the research effort, and an agreement with Revenue Canada that the work really does represent legitimate scientific innovation.

The TRC is pursuing this item with Revenue Canada, to ensure that housing construction research is not unduly penalized.

Engineered Wood Floor Systems

This structural system is gaining wide acceptance. We are looking for any information (good or bad) on your experiences. Contact Ross Monsour at CHBA.

Kitchen Cabinet Requirements in the 1995 NBC

The latest edition of the National Building Code has new requirements for kitchen cabinets. These include horizontal clearances to wall framing and cabinets and vertical clearances above the level of burners within a certain horizontal distance of the burners. The intent of the changes is to ensure a minimum clearance to combustibles from the elements on a stove. However, it seems that these changes represent a case of not enough comment or scrutiny from industry during the code review process, so a change that seemed workable at first glance is not practical.

The issue is that the new clearances call for significant design changes, a potential reduction in cabinet space, or altered cabinet construction (e.g. protection of the lowest cabinet section over the stove by asbestos millboard and sheet metal).

A microwave cabinet next to the range would not be feasible, and there would be less upper cabinet space immediately adjacent to the range. For an equivalent amount of cabinet space the kitchen would have to be enlarged.

Several provinces have raised the issue and TRC has sent a letter requesting a change be considered to this version.

It seems that this one has slipped by in the code review process and we are being supported by the kitchen cabinet manufacturers' association.

CHBA on the Internet
Visit the CHBA Internet site at:
http://www.chba.ca

The TRC newsletter can be found on this site.

You asked us: *about gas appliances & healthy housing*

We are building a new healthy house. Healthy design and construction concerns are important. Can we still use gas appliances?

Natural gas combustion gases are relatively clean. The major concern with gas appliances is that their combustion products may spill back into the house. The concern for gas spillage does not mean that all gas appliances are to be avoided, rather only those that have the potential to back draft flue gases through their design. Nitrous oxide gases (which represent very small quantities of combustion products) are problematic for some allergic people. Thus, strictly from a health perspective, any open combustion should be avoided inside the house. Obviously, it is important that equipment be installed properly.

Gas hot water heaters should be sealed combustion, direct vent units. Standard naturally aspirating (open draft) water heaters should be avoided, as there is evidence that they spill combustion gases back into the house quite frequently.

Furnaces should also be sealed combustion units. Many furnaces and hot water tanks are power vented. These use a fan to generate the draft needed. These are better than the older natural draft units, but there is still a possibility of some back drafting.

Natural gas fireplaces should be sealed, direct vent units. These units isolate combustion from the room.

Gas ranges are more problematic. They have cooking performance characteristics that are desirable but venting the combustion products from the open flame elements totally is not always easy. If there is a concern or if someone is sensitive, gas stoves should be avoided.

Obviously, unvented gas appliances should never be used inside a home.

Energy Value Housing Award

This Award program recognizes builders who integrate energy efficiency into all aspects of their new homes from marketing and construction to energy performance. The purpose is to educate the home-buying public and other builders about real-world success stories in voluntary energy-efficient construction

The Energy Value Award is organized by the NAHB Research Centre with the U.S. Department of Energy, the NAHB Standing Committee on Energy, and Professional Builder magazine.

The judging criteria include:

Energy Performance (40%): what makes the home more energy-efficient than code houses.

Design (20%): how are energy and resource efficiency are considered during the design process.

Construction (20%): how management and construction processes incorporate energy features into the home.

Marketing and Customer Relations (20%): how is energy efficiency incorporated into marketing and customer relations.

Only professional U.S. builders are eligible to enter (this year's deadline has passed) and winners are announced at the NAHB Builder Show in February. Perhaps it's time for CHBA to follow this model for all the New Home SAM awards.

Marketing Environmental Technology

R-2000

R-2000 Program News

For Information on the R-2000 Program, contact your local program office, or call 1-800-387-2000

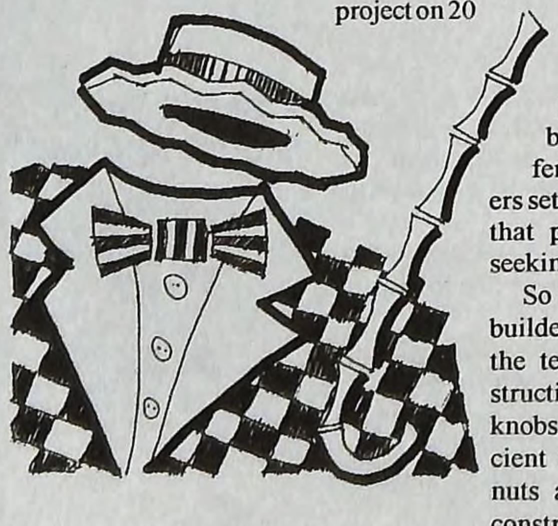
Marketing people long ago learned that it's the sizzle that sells. Just look at the products being promoted these days. Are they selling you the product, or are they selling you a lifestyle image, the product being the vehicle to achieve the desired end?

You don't see bread crumbs advertised on TV, but when they add some spices and call it Shake 'n Bake, they sell you the image that you can magically produce perfect gourmet dishes if you use the product.

The phone companies don't advertise that they will charge you for every second of airtime you use your cell phone. Rather, they show how wonderful it is that you or your family members can go anywhere and not be afraid that you will get stuck in the middle of nowhere without help.

The automakers don't advertise that when you buy their products you must buy insurance, pay for maintenance, guzzle lots of gasoline only to pollute the air and, if you live in a major urban area, be stuck for hours in traffic jams. Rather, they generate images of freedom and comfort as you cruise down an empty highway through a bucolic countryside.

Look at the marketing campaigns of the large real estate developments, where independent marketing specialists are brought on board to sell the developments. The sales pitch usually focuses on warm and fuzzy images - a house in a country estate; the family consisting of mom, dad and two kids playing on a large lawn with horses and cows in the distance (even if the project is a rowhouse project on 20 foot lots, with the lawn a postage stamp piece of dirt with three blades of grass; the patio separated from the neighbours only by a flimsy wooden fence). The point is the marketers set the tone for the lifestyle image that prospective home buyers are seeking.



So what does the average small builder do? Generally, he focuses on the technical features of the construction: the 2x4's or 2x6's, the doorknobs and cabinets, perhaps the efficient furnace, and the many other nuts and bolts items used during construction. It's not surprising that this is the focus, since it's what he knows best. But how does that relate to what the purchaser is looking for? Chances are most don't know the difference between 2x4 and 2x6, plywood or OSB, copper piping or plastic. The purchaser is looking for a *home*.

In part, much of this is due to the fragmented nature of the home building industry - there are very few large players, and no "vertically integrated" companies involved in all phases of the design, manufacturing and construction process. Most builders play a key role as assemblers of products produced by others.

A house is a system greater than the sum of the individual parts, so how the elements are put together is vital. Many home purchasers, even those doing their homework and checking on the technical aspects, don't always fully appreciate the consequences of various decisions. Some of the biggest misconceptions arise due to lack of understanding of fundamental building science issues. After all, no one questions that a car needs wheels, you may not buy the top of the line tires and rims, but you'll still have some. Yet in a new house, how many builders and purchasers stop short of installing a fully functioning ventilation system? Or assume that the house doesn't need to be airsealed because the "house has to breathe" (don't confuse us with the facts).

The challenge for the R-2000 builder is to stress the enhanced liveability features of the home because of the R-2000 technical features incorporated into the house. That because sound building science has been used in the construction the house will be more durable, better quality and more liveable. Take full advantage of testimonials from previous R-2000 customers - referals are usually the best promotional support you can get.

The R-2000 Program's quality assurance focuses on the technical aspects. That is what ensures that the finished product will in fact deliver the things the home buyer is looking for: a more comfortable, quieter, healthier, energy efficient home environment.

There is a very fine line between selling the technical features and stressing enhanced lifestyles. The R-2000 nameplate offers the potential for enhanced marketability and presence in a market with no-name products.

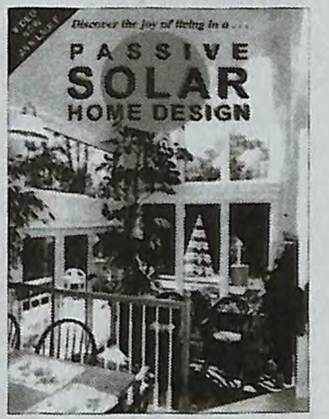
Passive Solar Video

Passive solar design can make a home more comfortable and also provide a significant portion of its heating needs. Because there are few dedicated pieces of hardware one can point to and call "solar," it can often be a hard sell. It is the *concept* of passive solar design that has to be sold.

The Nova Scotia Ministry of Energy (with support from NRCan) has developed a video that walks you through 5 Nova Scotia passive solar homes, and shows how liveable solar houses can be. The video is very accessible for the average home buyer, laying out in simple terms the key ideas involved in passive solar design. Most of the homeowners add their own thoughts on what it is to live in a passive solar house.

This 12 minute video is well worth looking at, and letting your customers see.

Copies are available on a loan basis within Nova Scotia, and are sold at the Nova Scotia Government Bookstore, for $15.00 plus shipping and handling. A limited number of copies are available from Mary O'Keefe at Natural Resources Canada in Ottawa.



For more information:
N.S. Government Bookstore
P.O. Box 637
Halifax, N.S. B3J 2T3
tel: (902) 424-7580
fax: (902) 424-8425

E-mail: warnergw@gov.ns.ca
or
Mary O'Keefe, NRCan
Tel: 613-947-1203
Fax: 613-943-1590

Letter to the Editor

Sir,

I always take pleasure in receiving your publication. We have excerpts of Solplan Review posted on our office wall, notably your article on frost-protected shallow foundations from your Apr-May, 1994 issue. We use this to help convince our radiant floor heating customers of the importance of perimeter insulation.

We were pleased to see your article on radiant floor heating in the March 1996 issue. As usual, your treatment of the subject is comprehensive. I was, however, surprised by your dismissal of claims of energy efficiency, and your attribution of such claims to "salespeople."

For a general statement on radiant heating, I refer you to the September 1989 issue of the ASHRE Journal. It includes an article "Application of radiant heating saves energy." The article begins, "Application of radiant principles is one of the best kept secrets of the 20th century. Why is this surprising? Because people do not know that, in many applications, radiant heating can reduce energy costs by 30 per cent or more with equal comfort

The Ontario Ministry of Housing (Thunder Bay office) and Centra Gas Ontario Inc., did a study that compared the energy efficiency of four seniors housing projects in northwest Ontario. All four use gas-fired boilers as their energy source; the differences are in the heat distribution systems. Three of the projects use hydronic baseboard heating, the fourth uses hydronic radiant floor heating. They found that the one with radiant floor uses nearly 40 per cent less energy than the other three.

Terry White
Pilot Butte, SK

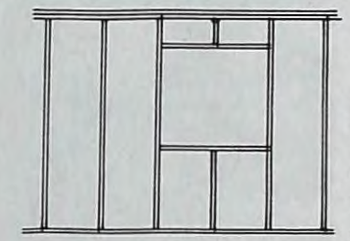
Thank you for bringing this issue to our attention. The dramatic energy savings highlighted in the ASHRE article are for commercial and industrial applications, where radiant heating is especially well suited as it does not heat the air and the volume and air change rate in a warehouse or auto mechanics shop can be very large.

There is no doubt that energy savings in a residence with radiant heating can be achieved provided the system is operated properly - this means keeping air temperatures cooler than is the norm. Unfortunately, most home owners don't understand this, and most systems are controlled with conventional thermostats usually used with forced warm air heating systems. Consequently, homes are heated to warmer temperatures than needed - if the house is kept warmer, there won't be such great savings.

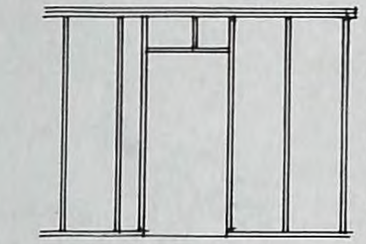
This is an important principle that is not always well understood, and in my experience, not always explained by salespeople. Ed.

Advanced Framing Techniques

by Martin Mattes



Co-ordinated advanced framing window opening (studs @ 24" o/c)



Single framing for doors, non-loadbearing partition (studs @ 24" o.c). Conventional double framing, additional cripples, etc. are not always needed

Advanced framing, also known as OVE (optimum value engineering), is accepted engineering practice.

Why frame using two top plates when the 1990 National Building Code of Canada (9.23.11.3 (3)) requires only one top plate? Eliminating that extra lumber will dramatically reduce the thermal bridging through framing and will dramatically increase the effective R value of the wall assembly. Laying out joists or rafters directly on top of studs not only speeds up assembly but increases bearing capacity, reduces nail pops and best of all reduces the amount of lumber used. Overall construction costs can also be reduced.

The ideal scenario is to frame 16" o.c. on your first storey or pony wall and orient your joists directly on the studs. These may be placed within 50 mm of the stud (9.23.11.(3)). All exterior walls running parallel with the floor joists are non-loadbearing and can be framed at 24" o.c.. Using 24" o.c. stud spacing for the second storey allows your trusses to bear directly on the wall studs. Placing the joists or trusses directly over the studs eliminates the need to lay out the wall a second time. Normally precut studs are 92 5/8" so by eliminating the upper top plate you either have to order them precut to 94¼" or cut them yourself. This is the only area that may be more time consuming and wasteful of material.

Studs 94¼" will give you an 8' ceiling height after you take strapping into account (read Table 9.29.5.A first and you may find out there is no need to strap). The result is that drywall doesn't need a ¼" cut off on interior walls and the insulation now fits perfectly without bunching up. Don't forget to read 9.23.11.4 (3 & 4) for tying in your corners and joints in the top plate. A truss gusset plate 75mm by150mm by 0.91mm is ideal.

Why use a 2" x 10" lintel when sometimes a 2" x 4" lintel will be adequate? (Table 9.23.12.A.) By using smaller lintels your jack studs remain the same length and you can cut the cripples out of waste material and again your effective R value has increased while reducing costs. On non-loadbearing exterior walls, eliminate lintels all together (9.23.12.1.(1)) After all, what are you supporting?

Take a close look at your framing and you will probably find there is far too much wasted lumber. For example, all those extra cripples put in here and there that don't support anything, below windows and on top of interior door openings or by a 2"x6" stud for backing instead of a piece of strapping. They are all just potential nail pops. Installing unnecessary lumber throughout the home doesn't necessarily mean better quality. The less lumber, the less sound transfer; the lower your energy and construction costs which could be spent elsewhere in the home to keep your clients happy. You might even consider reducing your drywall fasteners and gluing the sheets according to the glue manufacturer's instructions.

The latest HOT2000 Program (version 7), now allows you to model a home using advanced framing techniques and the results show a considerable difference in the energy consumption. So not only do you save on material costs, but your customers save on their operating costs.

So why are you using all that lumber? Stop overbuilding, save our forests and energy, and your profits will increase. Remember the old saying "If you've been doing it the same way for the last ten years, you are doing it wrong."

Martin Mattes is an R-2000 builder in the Annapolis Valley in Nova Scotia. He is also a director of the Atlantic New Home Warranty Corp.

Materials Emissions Tests

Environmental concerns mean a greater interest in the use of resource efficient, recycled materials. At the same time, the pollutant loading the products introduce is also becoming an issue.

The air quality inside buildings has gained a higher profile, as the public becomes aware of the connection between personal health and the environment. This is of special interest to Canadians, as the climate drives people to spend a large portion of their time indoors.

Building materials and furnishings have been identified as one source of indoor pollutants, and many emission investigations are being done. Indoor contaminant control strategies are based on reduction, removal and dilution of offending substances. Building codes now deal with the control of indoor pollutants only through mechanical ventilation but other than for asbestos, they do not refer to choice of materials with low pollutant content.

Another initiative gaining prominence is the reduction of waste from the construction industry. This has stimulated the development of products with recycled material content.

The Build Green Program in Ontario is a certification program that identifies and labels products with a known recycled content. The program promotes the use of building material with recycled content in the construction and renovation of buildings, increases awareness about Build Green products and helps to initiate the development of new products made from waste materials. This is aimed at diverting construction, demolition and municipal wastes from landfill.

While these materials use otherwise 'waste' materials, there are concerns that recycled materials may emit more indoor chemicals than conventional materials. Traditionally, construction products have been designed and developed based on product formulations that take into account performance issues such as durability, structural integrity, and fire resistance. However, existing material performance standards do not require materials to be evaluated for off-gassing. To find out if this is the case, Build Green and conventional materials were tested to assess their potential for off-gassing.

Emissions tests of representative samples of 37 Build Green and conventional materials were measured. Samples were forwarded in their product packaging, as if delivered to a construction site.

Materials tested included carpet, carpet undercushion, structural lumber, foundation material, insulation, drywall/fibreboard, counter tops and cabinetry.

In most instances, product chemical information was not available, and many manufacturers were reluctant to participate in the study. When the manufacturer would not send a sample, materials were purchased through commercial outlets or distributors and tests were done without product chemical information.

Emissions from building materials can originate from the building material, from the material finish, from chemicals applied during construction and from chemicals adsorbed from othersources.

Tests determined that the Build Green products evaluated emitted equivalent quantities of Volatile Organic Compounds (VOCs) and formaldehyde as compared to conventional products. Chlorinated hydrocarbons were not emitted from these building materials.

Flooring Two Build Green and four conventional carpet samples and three Build Green and one conventional under cushions were tested.

Structural Lumber Five structural lumber materials were tested, three Build Green and two conventional materials. There are no emission guidelines for structural lumber.

Table shows the range of emissions from various products tested.

		TVOC ug/m2-h		Formaldehyde ug/m2-h	
		Low	High	Low	High
Carpet	Build Green	<1	<1	<1	<1
	Conventional	10	500	<1	48
Undercushion	Build Green	<1	470	<1	<1
	Conventional	<1		12	
Structural Lumber	Build Green	67	290	4.1	8.4
	Conventional	46	360	4.4	23
Foundation	Build Green	<10	280	<4	<5
	Conventional	26	2300	<1	<3
Insulation	Build Green	5.9	8	5	35
	Conventional	<1	150	<1	300
Counter Top	Build Green	7.2		<1	
	Conventional	8.7	590	<1	175
Drywall/Fiberboard	Build Green	<1	220	23	1000
	Conventional	20	25	60	250

Insulation Eight insulation materials (two Build Green, six concentional) were tested. Formaldehyde emissions exceeded the VOC emissions. Formaldehyde is used in the manufacture of glass fibre insulation. There are no emission guidelines for insulation material.

Counter tops, fibreboard and cabinetry There are also no emission guidelines for counter tops and cabinetry.

Gypsum wallboard Three Build Green gypsum and fibreboard samples and two conventional drywall materials, obtained from commercial outlets were tested. The higher VOC and formaldehyde emissions are probably the result of these samples having acted as sinks at the commercial outlet where the products were obtained.

Foundation Two Build Green, two conventional systems were tested. The cast-in-place concrete had one of the highest VOC emissions of all materials. This was not from the concrete, but from an oil product used with concrete forms.

The results show that the quantity of emissions covers a wide range. This variability is not surprising due to the lack of attention of manufacturers to emissions and the lack of standard emissions test methods for these materials.

The off-gassing results represent a "first look" at a wider range of traditional building products. The data shows that off-gassing should be an integral product performance issue for all construction materials.

To integrate off-gassing information in construction activity, materials emission criteria need to be an integral part of product formulation; an industry standard procedure needs to be developed for sampling materials, and a detailed analysis of emission rate-of-decay and the relationship between lab test data and actual building air quality needs to be defined.

***Build Green and Conventional Materials Off-Gassing Tests** prepared by Ortech Corp., for CMHC*

Changes at CMHC

Canadian Housing Information Centre
General Enquiries:
(613) 748-2367
Internet
http://www.cmhc-schl.gc.ca

CMHC has reorganised its research functions. All technical research, information and related policy work are now concentrated in a new division called "Technical Policy and Research" to be run by Don Johnson. This change consolidates the activities carried out by the former Housing Innovation Division and Housing Research Division.

Another important section is the Canadian Housing Information Centre (CHIC) that holds the most extensive collection of housing information in Canada (if not North America) and is there to serve you.

Each of CMHC's five regional offices across Canada has a Senior Advisor, Research and Technology Transfer, who serves as a contact in that region. If you have a problem, or are looking for information, contact:

Atlantic	Jean Breau	(506) 636-4480
Quebec	Michel Desbiens	(514) 496-7829
Ontario	Debra Wright	(416) 495-2065
Prairies & NWT	Dave Jamieson	(306) 975-5128
B.C. & Yukon	Don Hazleden	(604) 666-8068

Coming Events

Building Better Roofs
An IRC technical seminar
Performance of roofing components and systems; roof design, construction and maintenance
when to re-roof; methods of analysis to evaluate roof systems; current field problems and how to solve them

Ottawa	September 26, 1996
Fredericton	October 16, 1996
St. John's	October 18, 1996
Charlottetown	October 21, 1996
Halifax	October 23, 1996
Saskatoon	October 30, 1996
Edmonton	November 1, 1996
Yellowknife	November 4, 1996
Winnipeg	November 6, 1996
Vancouver	November 19, 1996
Whitehorse	November 21, 1996
Calgary	November 25, 1996
Toronto	November 27, 1996
Toronto	January 29, 1997
Montreal	February 11, 1997
Quebec	February 13, 1997

Details:
Fax:(613) 952-7673

22-24 August, 1996
HRAI Annual National Business Conference, Whistler, BC
Information: Tel: 1-800-267-2231;
Fax 905-602-1197

9-11 September, 1996
Use of Recycled Wood and Paper in Building Applications Madison, WI
Information: Tel: 608-231-1361;
Fax 608-231-2152

27-30 September, 1996
Closing the Door on Toxic Construction: Building for Human Health
Carbondale, Colorado
Information: Tel: 970-963-8855;
Fax 970-963-8866

1-3 October, 1996
4th National Energy Efficient New Construction Conference Vancouver, BC
Information: Tel: 916-363-8383;
Fax 916-363-1788

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